

UPGRADE
WORKSHOP

Fit a new processor

Chris Finnamore shows you how to breathe new life into an old computer by upgrading its processor

THERMAL PASTE Your heatsink may have a square of conductive material on its underside. If not, use thermal paste to ensure good thermal contact between the processor and the heatsink



FAN This transfers the heat from your heatsink and disperses it. Without it, the processor would eventually overheat

HEATSINK If you buy an official 'boxed' processor, you'll get a certified heatsink that's guaranteed to cool your chip properly



PROCESSOR You will be able to fit only a processor that uses the same socket standard as your motherboard. This new Intel processor uses LGA775

INTRODUCTION

More than any other component in your PC, the processor determines how quickly your system can run software. Replacing the processor can give your PC a new lease of life, enabling you to tackle intensive tasks, such as video editing or games, that would otherwise be impossible no matter how extensively you upgraded your other components.

This Upgrade Workshop takes you through choosing, fitting and testing a new processor. We'll assume you're attempting to fit a new processor in an existing motherboard. However, we'll also explain how you can tell if your existing components will make a simple chip swap difficult or ineffective. In these cases, you may want to consider buying a new motherboard, too. This increases the cost of your upgrade but lets you choose any processor you want.

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When upgrading your PC's processor, it's often possible to fit a faster one in your existing motherboard, but you must be sure that the new chip is compatible. This demands some careful research. The first thing to check is the processor socket your motherboard uses. The main processor makers, Intel and AMD, use different sockets, and they regularly bring out new sockets, typically increasing the number of connectors to support their chips' ever-growing capabilities. Only processors designed for the socket standard your motherboard uses will fit in your board.

The current Intel socket standard is LGA775, while the current AMD socket is Socket AM2. There are plenty of processors available for both socket types, but even if you have an older socket, you may be able to upgrade. If you have an AMD Socket 754 or 939 or an Intel Socket 478 motherboard, you should still be able to upgrade your processor, but bear in mind that your choice will be very limited with a Socket 754 or 478 motherboard, and processors may be hard to find. Socket 939 processors are still fairly plentiful, however. If you have a socket older than these, you'll have a hard

Compatibility checklist



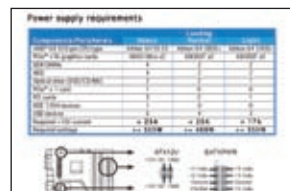
SOCKET

Check that your motherboard's socket type matches that of the processor you want. The socket type is listed in the manual for your motherboard, and may be printed on the socket. You can also try the CPU-Z utility from www.cpubid.com (which refers to socket standards as 'packages'). Recent AMD processors come in Socket 754, 939 and AM2, while Intel chips are Socket 478 or LGA775.



COOLER

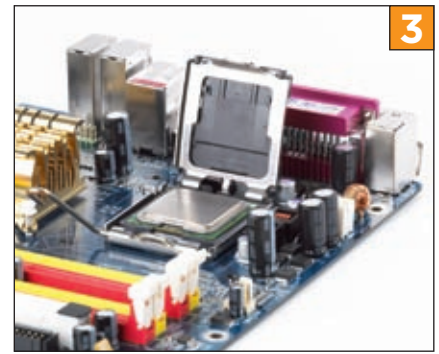
A faster processor will probably generate more heat than your old one. Your existing cooler may not be able to dissipate this, causing your new chip to get hot, which can damage it. Check your existing cooler's capabilities using Google to identify the cooler and the processors it's designed to cool. If you're not sure about your existing cooler, buy a boxed processor with a certified heatsink and fan.



POWER SUPPLY

Modern processors have fairly hefty power requirements, and your current power supply may not be up to the job. Check your motherboard's manual or the processor manufacturer's website for details on the power requirements of different processors. If your power supply can't provide enough juice, it's time for an upgrade. See this month's Power Supply Labs on page 102.





time finding a compatible processor and it may not perform much better than your current chip.

To find out which socket your motherboard uses, consult the manual. If you don't have the manual, you should be able to find the model number printed on the motherboard and download a manual from the manufacturer's website. If you can't find the model number on the motherboard, the free CPU-Z utility from www.cpubid.com should be able to identify the make and model for you.

Even if a processor physically fits in your motherboard, it may not work with it. The best way to be sure of compatibility is to visit your motherboard manufacturer's website. Go to the page devoted to your motherboard and you should find a link to details of processor support. This should list all the processors that are known to work in the motherboard, and will probably be more up to date than the manual.

There are many reasons why a processor of the correct shape might not work in a board. If the motherboard's BIOS – the program that configures the motherboard's many settings – predates the processor, it may not recognise it and so can't implement suitable settings. This problem can often be fixed by downloading a BIOS update from the board manufacturer's website. Some motherboards have a BIOS update program that runs from within Windows, while others run from a bootable floppy disk.

Another compatibility issue that affects only Intel processors is the Front Side Bus (FSB) speed. The FSB is the interface that connects the processor to the board's memory controller, and different Intel processors require different FSB speeds. Your motherboard will support only certain FSB speeds, and you can't enhance the range allowed with a BIOS update. Before you buy a processor, make sure your motherboard's bus can run fast enough. The bus speed quoted for the processor will be four times the bus speed of the motherboard. For example, a 2.8GHz Pentium 4 has a 533MHz FSB, so your motherboard's bus will have to run at 133MHz, while a 3.0GHz Pentium 4 has an 800MHz FSB, so needs a motherboard with a 200MHz bus.

Further subtle compatibility issues lurk, such as differences in power requirements, so checking your individual motherboard's listed CPU support is the only way to be safe. This is especially true if you're planning to fit one of the new Core 2 Duo processors, which relatively few motherboard chipsets support.

BEST BUYS

When upgrading there's little sense in buying a top-of-the-range processor as it will be held back by all the older components in your PC. Besides, top-of-the-range processors tend to be disproportionately expensive. If you have a current or fairly current AMD Socket AM2 or Socket 939 motherboard, we'd advise you to spend around £120 and get a dual-core AMD Athlon 64 X2 processor. If your Intel Socket LGA775 motherboard supports Intel dual-core processors, £120 will get you a mid-range Intel Core 2 Duo for a significant speed boost.

If you're upgrading an AMD Socket 754 board, the fastest readily available processor is the AMD Sempron 3000+, which costs £25 from www.ebuyer.com. The fastest Socket 478 processor that's easy to find is the Intel Pentium 4 3.0GHz, which requires an 800MHz FSB. If your motherboard supports only processors with a 533MHz FSB, the Pentium 4 2.8GHz is the one to buy. These will cost you £57 and £47 from www.dabs.com. Neither processor is especially fast, so if you want to edit high-definition video, say, you need to upgrade your motherboard.

INSTALLATION

We'll assume that you are replacing an older processor in your PC, and that this has a standard AMD or Intel cooler fitted. The procedure described here should still work if you don't have a standard cooler, but if you're in any doubt, consult the cooler's manual.

Before you touch any of your PC's components you should ground yourself to discharge any static electricity build-up by touching a metal object such as a radiator. Also, run your PC for a few minutes before you start. This will warm up the thermal paste on the

processor and prevent it sticking to your processor cooler when you remove it. All types of cooler have a fan that plugs into a socket on the motherboard, so locate this and unplug it before you begin.

The procedure for removing the processor cooler and processor is almost identical for AMD Socket 754, 939 and AM2 chips, but Intel Socket 478 and LGA775 are different. If you have an AMD motherboard, go to step one. If you have an Intel board, skip to step two or three as appropriate.

1 REMOVE AN AMD COOLER AND PROCESSOR

AMD coolers are held in place with two metal catches that connect to plastic clips on the motherboard, one of which has a plastic lever. Raise the plastic lever to loosen the cooler, then unclip both sides and lift the cooler off. The cooler may be stuck in place with thermal paste. If it's not easy to remove, gently slide it from side to side to free it from the processor. Don't try to yank it loose, as you may wrench the processor from its socket. Put the cooler to one side, placing it upside-down so you don't get thermal paste on anything.

The processor will now be exposed. Next to the processor socket is a lever. Lift this into a vertical position to free the processor's pins. Holding the processor by its edges, lift it straight out of the socket. It should come out easily. If there is any resistance, make sure the lever is completely upright. Now skip to Step 4.

2 REMOVE A SOCKET 478 COOLER AND PROCESSOR

Intel Socket 478 coolers have two retaining levers opposite each other. To release the cooler, push down on the levers simultaneously to release them, and lift the cooler straight off the processor. The chip will sometimes come out with the cooler, but this shouldn't do any damage as long as you lift the cooler off straight.

To remove a Socket 478 processor, look for a lever next to the processor. Lift this into a vertical position to free the processor, then grip

it by its edges and lift it straight out of the socket. If it doesn't come away easily, check that the lever fully upright. Now skip to Step 4.

3 REMOVE AN LGA775 COOLER AND PROCESSOR

Socket LGA775 coolers are not held in place with clips. They have four feet that clip into holes in the motherboard. On each foot is a slot and an arrow. Insert a flat-head screwdriver into the slot and turn each foot 90° clockwise towards the arrow. One at a time, grip each foot and pull it straight up. It should click up and come free. When all four feet are free, lift the cooler straight up from the processor. If a foot appears to be stuck, give it another tug to make sure it's free.

Socket LGA775 processors are held in place by a cage in two halves. There is a lever next to the cage. Push the lever down slightly and then across to clear the catch. Lift the lever into an upright position and open both halves of the cage. The processor doesn't have any pins, so you can pick it straight up.

4 FIT THE NEW PROCESSOR

Intel Socket 478 and AMD Socket 754, 939 and AM2 processors have hundreds of pins on the bottom of the chip, which fit into holes in

the socket. To fit the processor, first make sure the lever is upright. There is an arrow in one corner of the processor, and a similar arrow embossed in the socket's plastic surround. Align these and place the processor on the socket. The chip should drop into place without the need for any force. If it doesn't go in, or some pins drop in and others don't, you may have some bent pins. Bear in mind that AMD Socket 939 and AM2 chips look very similar, but won't fit in each other's boards. Remove the processor and look sideways at the pins. If any look out of place, slide a credit card between the rows of pins and very gently straighten them. Once the processor is in place, lower the lever to lock it down.

To fit an LGA775 processor, make sure the cage is open. LGA775 processors have small indentations on the edge of the chip's plastic surround. Match these to the notches in the socket, and lay the chip on the socket's pins. If you've inserted it correctly, it will sit absolutely level. Now close both sides of the cage and lock the lever in place.

5 APPLY THERMAL PASTE

Some processor coolers already have thermal paste on their underside, but if not you need to apply some. If your cooler already has

thermal paste on it, you can skip this step. Thermal paste smoothes over the microscopic imperfections in the processor's heat spreader and the bottom of the processor cooler to ensure that the maximum amount of heat is transferred between them. Make sure the processor is clean, then squeeze a dollop of thermal paste on to it and spread it evenly over the chip with a piece of card.

6 FIT OR REFIT THE COOLER

Place the cooler on top of the processor. To fit a Socket 478 cooler, make sure the levers are in the open position, then place the cooler on the processor and attach all four clips to the socket's notches. Apply pressure to both levers at once to lock the cooler in place. To fit a Socket 754 or 939 cooler, attach the clip on the opposite side to the lever, then attach the other clip and lower the lever to lock the cooler in place.

For Socket LGA775 heatsinks, use a flat-bladed screwdriver to turn each foot anti-clockwise away from the arrow. Put the cooler on the processor with each foot in one of the holes on the motherboard. Now press each foot down with your thumb until it clicks into place. Finally, plug the fan back into the appropriate header on the motherboard. 

Testing and troubleshooting

Once you've successfully installed your processor, you should check that your system recognises it and that it's working properly. Start up your PC and check the POST screen carefully. The system should show the name of your processor. You may have to press the Tab key to switch from a logo screen to the POST screen. If the name of your processor is wrong, or the system reports the processor as "Unknown", your motherboard doesn't recognise the chip. Try updating the BIOS.

To make sure your processor isn't running too hot, find its temperature reading in the BIOS. This should be listed under PC Health or something similar. The correct temperature for your processor depends on its type. Pentium 4 processors can run at a maximum of 70°C to 100°C, Athlon 64s between 70°C and 95°C, and Core 2 Duo processors between 35°C and 65°C. As a rule your processor should operate as far below these limits as possible. If your chip is too hot, check that your processor cooler is on properly and that there is an even spread of thermal paste between the processor and cooler.

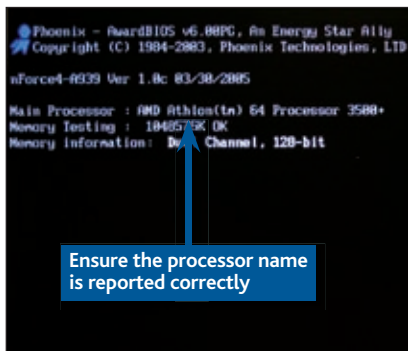
To check the processor is running at the correct speed, boot into Windows and run CPU-Z. The processor speed is listed at the bottom of the CPU tab. Check that this matches your processor's specifications. The motherboard may throttle the processor down when idle to stop it getting hot, so run a burn-in program such as Hot CPU Tester Pro (www.7byte.com). This runs the processor at 100 per cent load, so you can double-check the speed in CPU-Z. If it's still running at the wrong speed, update your BIOS. If it's still wrong, you may have to set up the processor speed manually using the BIOS utility.

If you've replaced a single-core processor with a dual-core chip, Windows XP sometimes won't pick this up. To check, run the Task Manager by pressing Control-Alt-Delete and click the Performance tab. There should be two graphs under CPU Usage History to represent each core of your processor, and even four if you have certain Intel Pentium 4 Extreme Edition chips. Pentium 4 processors with Hyper-Threading will also show two graphs.

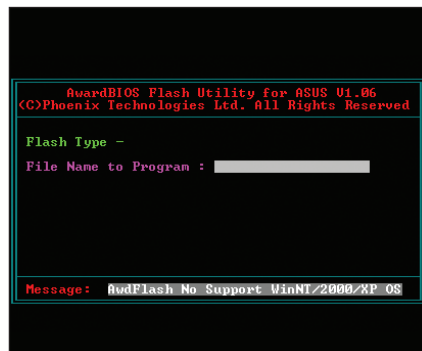
If there is only one graph, Windows hasn't recognised your processor's second

core. You'll need to run the Repair function from the Windows XP installation disc. Boot your PC from the XP disc and, when you're asked whether you want to install XP or repair an existing installation, choose Install and go through the installation process. Windows will tell you that it has found an existing XP installation and ask whether you want to repair it. Choose Yes and run through the rest of the routine. When you finish, Windows will be exactly as it was before and your programs and documents will be intact, but both your processor's cores will be detected.

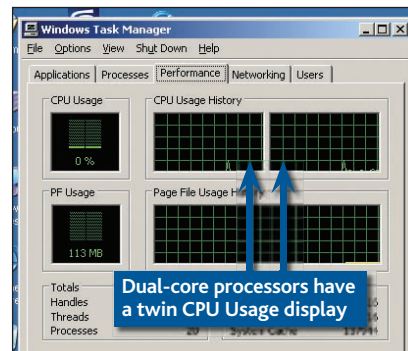
Finally, benchmark your system using an intensive benchmark such as Realstorm or Cinebench (www.realstorm.com and www.cinebench.com). Both programs will give you a score and compare it with those of various reference processors, so you can tell whether your processor is running as it should. While running the benchmarks, keep an eye on your PC to make sure it's stable and not overheating. You can keep an eye on your processor's temperature using SpeedFan from www.almico.com/speedfan.php.



▲ Details of your new processor should appear in the POST screen when you start up your PC



▲ If your system fails to recognise your new processor, you may need to update the BIOS



▲ Check that Windows has detected your new dual-core chip in the Task Manager